ON05869

Ministry
of
Education
Ontario

COMPUTERS ACROSS THE CURRICULUM

Junior Kindergarten to Grade 12/OAC

Consultation Document

June 1991

93-00336/

COMPUTERS ACROSS THE CURRICULUM

Junior Kindergarten to
Grade 12/OAC

Consultation Document

- Issues and Options
- Draft Policy Document

June 1991

COMPUTERS ACROSS THE CURRICULUM

Junior Kindergarten to Grade 12/OAC

Issues and Options

Please return this Issues and Options questionnaire by September 30, 1991 to:

Florence Scroggie
Ministry of Education
Curriculum Policy Development Branch
16th Floor, Mowat Block
900 Bay Street
Toronto, Ontario
M7A 1L2

INFORMATION SHEET

Please complete this page and attach to your submission.

Name: (Full name of the person/representative group/organization/board etc., where applicable)

_____

Address: _____

_____

Contact Person: _____ Telephone: _____

Please ☑ in proper place.

1. ☐ School Board
2. ☐ School Staff
3. ☐ Parents' Association
4. ☐ Subject/Educators' Association
5. ☐ Trustees' Association
6. ☐ Faculty of Education
7. ☐ Personal Response
8. ☐ Other Organization

How many people had input in the preparation of this response? _____

Where applicable, please indicate the division(s) represented.

JK/SK _____ Primary _____ Junior _____

Intermediate _____ Senior _____ Other _____

Please forward responses, no later than September 30, 1991, to:

Florence Scroggie
Ministry of Education
Curriculum Policy Development Branch
16th Floor
Mowat Block
900 Bay Street
Queen's Park
Toronto, Ontario
M7A 1L2

COMPUTERS ACROSS THE CURRICULUM

ISSUES AND OPTIONS

Please circle option chosen and comment as desired.

1. AIMS

The Ministry of Education believes that equity of outcomes must be foremost in the thinking of all educators when planning and implementing learning activities for all students. Only by keeping equity of outcomes central to the program can all students be enabled to progress and achieve to the best of their potential. The aims of *Computers Across the Curriculum* are congruent with this belief.

1.1 These aims are appropriate for the integration of computers across the curriculum.

1.2 These aims are incomplete and should be expanded to include:

1.3 Other (please specify)

2. COMPUTERS AND THE LEARNER

Students are at the centre of the learning environment and activities. Each student is a unique individual with specific needs, growth patterns, cultural and racial backgrounds, and aspirations. The integration of computers in the students' programs must be tailored to their unique and diverse needs if their education is to provide them with all possible opportunities for success.

2.1 This section clearly reflects the characteristics of the learner and ways in which the computer can enhance these characteristics.

2.2 This section is too general, lacking specific reference to the learner's characteristics in early years, formative years, transition years, and specialization years.

2.3 Other

3. COMPUTERS AND THE LEARNING ENVIRONMENT

The computer with its related technologies adds another medium, another tool, and a new enriching dimension to an environment that should be stimulating, in which all students can learn.

3.1 Learning Objectives

3.1.1 Learning objectives for all levels and subject areas regarding the integration of computers should be included in this policy document.

3.1.2 Learning objectives for all levels and subject areas regarding the integration of the computer should be the responsibility of the school boards.

3.1.3 Keyboarding as a learning objective should be included as a policy statement.

3.1.4 Other

3.2 Student Access to Computer

3.2.1 The ministry should mandate a minimum amount of time for student use of a computer each week.

3.2.2 School boards should determine the amount of time for student use of the computer based on student's needs and availability of hardware and software.

3.2.3 Other

4. PLANNING AND IMPLEMENTATION

The proper planning of balanced and sound programs for students, including *Computers Across the Curriculum*, is a prerequisite for the success of their implementation. The implementation process brings to light the need for necessary adjustments to the programs to ensure that all students experience the positive effects of computer technologies on their learning.

4.1 Board Plan

4.1.1 Board plans regarding the use of computers across the curriculum should be approved by the full board of trustees.

4.1.2 Board plans regarding the use of computers across the curriculum should be approved by a board committee.

4.1.3 To ensure equity of outcomes, boards through their planning shall include a list of hardware and software features, necessary for students with special needs, in consultation with the Special Education Advisory Committee and the schools

4.1.4 Other

4.2 School Plan

4.2.1 The Principal should chair the development, implementation and review of the school plan regarding the use of computers across the curriculum, and the allocation of related resources.

4.2.2 The teachers should be responsible for the development, implementation and review of the school plan.

4.2.3 Other

4.3 Teachers' Plans

4.3.1 Teachers' plans for their particular subject or groups of students should include teaching and learning activities through the use of the computer.

4.3.2 The inclusion of teaching and learning activities through the use of computers in the teachers' plans should be optional.

4.3.3 Other

4.4 Computers Across the Curriculum Team

4.4.1 Principals should establish *Computers Across the Curriculum* teams.

4.4.2 Principals should have the option to establish a *Computers Across the Curriculum* team.

4.4.3 Other

4.5 Parents and Community

4.5.1 Parents and community representatives should be members of the *School Planning Committee* regarding the use of computers across the curriculum.

4.5.2 The inclusion of parents and community representatives on the *School Planning Committee* should be at the discretion of the school.

4.5.3 Other

5. EVALUATION

Evaluation is a necessary follow-up to implementation to determine the success of the programs. It should be undertaken at every level of the system to provide accountability and accurate reporting to parents.

Please refer to the section in the document on Evaluation and write comments under the following headings:

Student: _____

_____

_____

Teacher: _____

_____

_____

Principal: _____

_____

_____

School: _____

_____

_____

Supervisory Officer: _____

_____

_____

Other: _____

_____

_____

6. GLOSSARY

Please list any comments regarding the glossary.

7. OTHER ISSUES

Please list and comment on any additional issues related to the integration of computers across the curriculum.

COMPUTERS ACROSS THE CURRICULUM

Junior Kindergarten to Grade 12/OAC

Draft Policy Document

Please note that all shaded areas contain policy statements.

June 1991

Table of Contents

Preface 1

A View of the Future 2

Rationale 4

Goals of Education 6

Aims 8

Equity 9

Computers and the Learner 10

Computers and the Learning Environment 15

Planning and Implementation 19

Ministry of Education Directions 20

Responsibilities of the School Board 21

Responsibilities of the Principal 27

Responsibilities of the Teacher 30

Evaluation 31

Conclusion 33

Glossary 34

Preface

This document replaces Policy/Program Memorandum No. 91, "Integration of Computers Into Elementary and Secondary Curriculum" (February 2, 1987). Its content is based on the goals of education for Ontario. It provides direction to Ontario's educators on how to integrate computer technology into all areas of the curriculum on an equitable basis and to provide all learners — from Junior Kindergarten to Grade 12/OACs and including adults — with computer experiences that will enhance their learning.

A View of the Future

- Learners from different locations across North America discuss, using a computer network, local problems of acid rain and ways of solving them. The computer provides projections based on statistical material and visual models to illustrate and enhance their discussion.

- A learner uses language translation software to translate an article from a foreign language news source and incorporates it into a historical article that compares information from different news sources.

- An adult learns to read using a laptop computer that highlights the words for him as he reads them and dialogues with him about his reading. The computer can also scan and read text from a newspaper.

- A learner researches the design of airplanes on a data base. She then designs a scaled model of a plane using computer-assisted design (CAD) software and her drawings. She prints the plans, constructs a physical model of the plane, and finds that it actually flies.

- Members of a Grade 12 drama class mounting a production of Macbeth use a computer to help them research the history of the period, the nuances of sixteenth-century speech, and early Scottish dress. They then make a "desktop video" of the play with themselves in costume and the computer assisting with the design of the sets, lighting, and other aspects of production.

- A learner uses a computer to prepare a project on pioneers. The computer is used to co-ordinate video, sound, and text materials (e.g., maps, historical dramatizations, statistics, diaries). The learner makes a multimedia presentation that is the basis of a classroom discussion. As questions are asked, the computer finds and displays pertinent information.

Technological applications like these will be increasingly common both in society and in our schools. In the future computer-enhanced learning environments will greatly facilitate the realization of the aims and objectives of all areas of the curriculum in Ontario schools.

Rationale

Rapid technological innovations make enormous demands on the individual. Most people will be continually involved in new learning throughout their lives in response to the changing needs of the workplace. Their ways of learning and of reacting to the outside world will also be affected and shaped as technology alters their environment. It is the responsibility of our educational system to prepare learners for this world of change by integrating the use of computer technology across the curriculum and by providing them with the skills and knowledge they will require to adapt to and cope with the transformations taking place around them.

Computer technology is rapidly becoming an important tool of everyday life. Data bases, word processing, multimedia uses, spreadsheets, and graphic editors are being increasingly used to facilitate the gathering, processing, and communicating of information.

There are many classroom applications of computer technology:

- It can raise learners' self-esteem by allowing them to learn, explore, create, solve problems, take risks, make mistakes, and correct them in a non-threatening environment.
- It can enhance learners' creativity by simulating environments and a variety of situations. As a result, it can stimulate the imagination of learners and allow them to examine a number of options, ultimately leading to informed decisions, better outcomes, and creative designs.
- It can be used to motivate learners and to help them improve the quality of their work.
- It can provide learners with immediate feedback and a setting for creative activities.

- Its graphic and manipulative potential can allow learners to test different solutions, analyse results, and make predictions on the basis of existing data.
- It has the potential to challenge learners by exposing them to a variety of possibilities and to allow them to transfer acquired knowledge to new problems and situations.
- Computer technology can help learners take responsibility for their own education and become autonomous learners.

The use of computer technology in all areas of the curriculum will have an impact on curricular aims and objectives, on teaching strategies, and on the learning environment. In most cases both learners and educators are discovering how to use the technology at the same time, and this will result in new collaborative relationships. These new partnerships will also reinforce the concept that learning is a lifelong process.

Goals of Education

The policy described in this document supports the attainment of the goals of education established for the Province of Ontario, which are to help each learner to:

1. develop a responsiveness to the dynamic processes of learning;
2. develop resourcefulness, adaptability, and creativity in learning and living;
3. acquire the basic knowledge and skills needed to comprehend and express ideas through words, numbers, and other symbols;
4. develop physical fitness and good health;
5. gain satisfaction from participating and from sharing the participation of others in various forms of artistic expression;
6. develop a feeling of self-worth;
7. develop an understanding of the role of the individual within the family and the role of the family within society;
8. acquire skills that contribute to self-reliance in solving practical problems in everyday life;
9. develop a sense of personal responsibility in society at the local, national, and international levels;
10. develop esteem for the customs, cultures, and beliefs of a wide variety of societal groups;

11. acquire skills and attitudes that will lead to satisfaction and productivity in the world of work;

12. develop respect for the environment and a commitment to the wise use of resources;

13. develop values related to personal, ethical, or religious beliefs and to the common welfare of society.

Aims

All learners shall be provided with opportunities to:

- **have access to computers as part of their educational experiences on an equitable basis that takes into consideration their age, learning styles, exceptionalities, gender, interests, geographic isolation, and ethnocultural and linguistic uniqueness;**
- **use computers in the continuing process of learning in all areas of the curriculum from the early years to the years of specialization;**
- **use computers to facilitate the acquisition of knowledge and the development of skills and attitudes that they will require for lifelong learning;**
- **benefit from working with computers in all parts of their educational development — cognitive, social, emotional, and physical;**
- **use computers in a variety of learning processes and approaches (e.g., experimentation, inquiry learning, problem solving, interactive learning) and learning activities (e.g., drawing, writing, composing, calculating, role playing).**

Equity

Learners have a wide range of needs, interests, and abilities. Many of these can be accommodated through the use of computers. This is particularly the case for learners with special needs. For example, computers can be used to print Braille or synthesize a human voice that will read to individuals who have a visual impairment, and to facilitate the acquisition of literacy skills among learners who lack them.

Access to computers shall be provided on an equitable basis in order to foster equal opportunity for all learners — regardless of age, interests, exceptionality, gender, geographic isolation, or linguistic, economic, or ethnocultural background — and facilitate their full participation in society.

Computers and the Learner

The integration of computers and educational technology into the learning process promotes a progressive curriculum. It supports the goal of providing all learners with equal opportunity to learning by meeting individual learning needs, styles, and interests while enabling learners to enjoy and explore an enriched learning environment across the curriculum, from the arts and humanities to science and technology.

Computers and educational technology can be a catalyst that increases learners' motivation, involvement, and interaction. Learners are intrinsically motivated to pay attention to, explore, and experiment with a variety of stimuli (visual, aural, and kinesthetic) and become actively involved in the learning process when they use computers.

All learners, including those in Junior Kindergarten to Grade 12/OACs and adults:

- ***have a diversity of individual abilities, interests, learning styles, and social and economic backgrounds***;

  Learners develop physically, intellectually, and emotionally at different rates. They also have a variety of individual learning styles: visual, aural, verbal, and kinesthetic. The needs of visual learners can be met through colourful graphics or animation. Aural learners respond to programs that use sound to reinforce what is happening on the screen (e.g., the addition of objects to a primary addition problem, sounds to reflect moods created by words). Kinesthetic learners benefit from the use of robotics and other computer-controlled constructions, as well as from the use of the trackball and mouse. Multimedia programs are used to combine a number of learning modes to produce a multisensory learning environments suitable for a variety of learning styles. Computer hardware and software can help all learners — and in

particular second-language learners, exceptional learners, and adult learners develop autonomously and in keeping with their individual needs and physical abilities.

- ***are active participants;***

  Computer technology can be a catalyst that increases learners' motivation, involvement, and interaction. Learners are intrinsically motivated to pay attention to, explore, and experiment with a variety of stimuli (visual, aural, and kinesthetic) and become actively involved in the learning process when they use computers.

- ***require an immediate response and ongoing encouragement in an environment that is non-threatening and non-judgemental;***

  Learners enjoy the immediate feedback provided by computers. They benefit from the "safe" environment created by computer technology in which they feel free to make mistakes and learn from them.

- ***are capable of communication;***

  Computers can help learners communicate in a variety of ways. For example, they can facilitate the publishing and sharing of personal writing. (Word processing and desktop publishing applications enable students to produce high-quality professional products. Learners using them write more, produce higher quality products, are more willing to revise their work, and interact more with their peers than learners using pen and paper.) They can enable non-verbal, physically challenged learners to communicate through the use of augmentative devices (e.g., a unicorn board). Multimedia productions allow learners to use a variety of methods of presentation (e.g., videodisk, CD-ROM, graphics, text, sound) to express themselves. Learners in geographically isolated communities can instantaneously access the resources of other learning environments or communicate with peers in distant locations.

- ***are capable of interacting with each other in co-operative ways;***

  Learners interact and co-operate with other learners in computer simulations. For example, groups of learners around a single computer can reach a consensus on a decision and then proceed to implement it. Through telecommunications and networking, students can reach co-operative decisions while working on multiple computers.

- ***are guided by values;***

  The computer has no intrinsic gender, language, or culture. Its universality can open lines of communication and learning among people. It can provide learners with opportunities to examine values that differ from their own through simulations based on social, cultural, economic, and political contexts, both today and from the past. In addition, learners can interact with individuals from other cultures or countries through telecommunication networks.

- ***are capable of acquiring information from many sources;***

  The task of gathering and retrieving information can be facilitated through the use of the computer technology, freeing learners to spend more time on the analysis of data. Videodisks, telecommunication networks, and data bases from around the world can be used to access relevant information not available through traditional means. In a science class probes and sensors can be used to record and present data instantaneously. In an auto mechanics class computers are used to diagnose problems that learners can then attempt to solve.

- ***are capable of inquiry;***

  Computers can be used to provide learners with an interactive, non-threatening environment in which they can explore problems, both real and imaginary, test hypotheses, and generate solutions. Computer software allows students to

experiment with models that would be difficult to construct using other media. As a result, learners are challenged to develop creative and original solutions to new problems.

- ***are capable of analysis;***

  Computers allow learners to focus on the analysis of information in a variety of forms, such as graphs, maps, tables, and charts. "What if" programs allow learners to extend the boundaries of a problem and experiment with a number of alternatives. Ideas and concepts can be combined and recombined easily in ways not possible through other means. For example, in music computers can be used to write a song; play it; illustrate its lyrics; experiment with different tones, instruments, and tempos; edit various parts of the song; and then record it or print it out.

- ***are capable of synthesis;***

  Learners use computer technology to create new products from their component parts. For example, they can use desktop publishing equipment to create an attractive newsletter using print material and design elements. They can also compose music using a synthesizer that simulates the sounds of different instruments.

- ***are capable of evaluation and reflection;***

  Computer applications allow learners, both individually and in small groups, to discover facts, make decisions, test explanations, reflect on their thoughts and feelings, and articulate theories to which they have not previously been exposed.

- ***are capable of creativity.***

  Open-ended computer software enhances learners' ability to express themselves creatively in a variety of areas (e.g., writing, drawing, composing music, creating simulations).

For these reasons all learners shall:

- **use the computer and related technology to enhance their learning;**
- **benefit from using a variety of computer software;**
- **use stand-alone and network configurations to explore ways of communicating and collaborating with others, both inside and outside the school;**
- **understand the value and role of computer technology in society.**

Computers and the Learning Environment

An effective learning environment stimulates learners' minds, helps shape their ideas, motivates and challenges them, and enhances their self-esteem. Computer technology can make available extensive, up-to-date, learning resources. It can enrich and expand the learning environment, both within the classroom and beyond, especially through the use of multimedia and telecommunication equipment. Computer technology can also provide learners with environments that cannot be created or duplicated through traditional educational resources.

An environment that is rich in computer technology includes access to a good variety of software, multimedia equipment, and telecommunication facilities so that activities like the following can take place:

- Learners share information that they have collected about their local community with learners in other communities on an electronic bulletin board.
- Learners access an electronic encyclopedia during their work on a research project.
- New Canadian learners access a CD-ROM that facilitates their learning to read and speak English or French.
- A group of four learners participate in a historical simulation at a computer in a classroom. Attached to the computer is a videodisk or CD-ROM player. The learners make decisions collaboratively and prepare a presentation for the rest of the class.
- Learners in a creative writing class benefit from the ease of creating, illustrating, and revising their work provided by a word processing or publishing program.

It is important that computers be organized to match learners' curriculum needs and the teaching/learning strategies used by the teacher. These configurations can include learners working at classroom activity centres with one to four computers or in computer laboratory classrooms with many computers. The computers can be organized as stand-alone work stations or in network configurations. When learners have the opportunity to work individually, with partners, and in group learning situations using computer technology in this kind of environment, they become actively involved rather than being passive participants.

In order to relate the activities in a computer laboratory directly to learning in the classroom, it is important that the regular classroom teacher accompany learners to the laboratory. Future environments may include the "in-class lab", with sufficient computers in the regular classroom so that each learner can work alone or with a partner.

Networked computers in classrooms throughout the school allow for the sharing of resources and for communication among learners and teachers in the whole school. For example, a group of learners can use conferencing software to debate an environmental issue with a group of learners in another part of the school. It is important that the planning of facilities ensures that the necessary electrical, telephone, and cable support for networking are available.

Computers must be as unobtrusive as possible in the learning environment. When used as work stations and as presentation tools, they must be mobile and easily adaptable. When used as a learning centre, it is important to place them outside of the regular flow of traffic, yet where they are accessible.

It is important that teachers shape the physical environment around the computer taking into consideration lighting, seating arrangements, work space, ventilation, safety, and ergonomics. Several learners should be able to work at a computer at the same time without being crowded or physically cramped.

Learners are especially intrigued by the versatility of computer technology. Teachers can support this natural desire to explore the computer by designing responsive environments that are inclusive of materials and experiences that invite learners to use their computer interactions as an extension of their other learning experiences, probing ideas and concepts in physical, visual, tactile, aural, cognitive, and social modes.

Learners are strongly influenced by how others interact with computer technology. For this reason it is important that teachers:

- view computers as a learning tool that can be used to facilitate learning;
- view computer technology as something that is inside rather than outside of the regular curriculum;
- personally feel comfortable with computer technology.

Through the use of computers and appropriate software, teachers have the opportunity to create environments that present learners with successful, challenging experiences with computers, motivate them to seek new and additional ways of using computers, and foster a positive attitude towards achievement. Computers can help remove physical barriers and permit learners to access other learning environments, communities, and worlds, real or imaginary, where they can explore, experiment, and learn.

Educators shall design an environment to meet the needs of all students and help them reach their full potential. To facilitate this the following elements shall be present in environments where learners use computers:

- **The learning environment in every curricular area and level shall include the use of computer technology to enhance and complement the attainment of curricular aims and objectives.**
- **All learners shall have opportunities to work individually, in pairs, and in group learning situations using computer technology that is organized to match their curriculum needs and their teachers' teaching/learning strategies.**
- **The individual shall be in control of the technology.**
- **The use of computer technology shall be related both to other learning experiences in the classroom and to the daily routine.**
- **The arrangement of the technology in the classroom shall promote the interactive involvement among learners and between the learner and the computer.**
- **The learning experiences shall stimulate cognitive and social growth.**
- **The physical environment in which computers are used shall be ergonomically sound and comfortable.**
- **The learning environment shall contain a variety of software, multimedia equipment, and telecommunication facilities.**
- **The learning environment shall contain networked computers that allow for the sharing of resources and for communication among learners and teachers in the whole school.**

Planning and Implementation

Effective planning is a consultative process. It begins with the identification of learner needs, teacher needs, and school/community needs. This is followed by the co-operative development of a plan that meets board and Ministry of Education policy directions. Thorough planning at the classroom, school, and board level is essential to provide computer activities that will meet the needs of all learners and provide both learners and teachers with a sense of accomplishment. Planning is also required to make the most effective use of valuable educational resources.

Planning for the use of computer technology in schools must ensure that all learners at all grade levels in all subjects have equitable access to computers. In secondary schools a balance must be maintained between the number of computers available for subjects that require concentrated computer use and the number of computers allocated for use in all other subjects. The special needs of exceptional students must also be considered.

Since 1986 the Ministry of Education has funded board projects that highlight innovative uses of computer technology and its implementation into the curriculum. Research studies, videos, and reports are available to school boards through ministry regional offices so that the experiences from the implementation projects can be shared throughout the province.

The ministry, school board officials, principals, and teachers share the responsibility for making effective use of computer technology. All implementation strategies for computers and for educational technology should focus on providing learners with the resources and the environment that they require. These strategies should outline the responsibilities of all agents involved in this process.

Ministry of Education Directions

The Ministry of Education supports the following initiatives:

- the development of curriculum guidelines that set out:

  a) the use of computer technology in all divisions and subject areas;

  b) appropriate expectations of computer use by learners in curriculum programs;

  c) methods of evaluating the effective use of computer technology in specific program areas;

  d) specific statements, explanations, and learning expectations regarding the use of computer technology within the learning process. These statements shall outline suggestions for the use of computers as both a productivity tool and a learning tool in both individual and collaborative modes;

  e) the need to reconsider assessment and evaluation when technology is being used;

  f) appropriate expectations of computer use by learners in each program area;

- the promotion of partnerships among the Ministry of Education, school boards, faculties of education, and other special interest groups regarding the sharing and development of exemplary models and resources for the implementation of computer technology into the curriculum;

- in co-operation with special interest groups, the development and publication of both resource documents on the integration of computers into the curriculum and exemplary board and school-based computer plans.

Responsibilities of the School Board

The board shall develop a policy on the use of computer technology across the curriculum. Each year it shall produce a flexible long-term plan for the integration of computers into and across the curriculum. This plan, which shall be available to the Ministry of Education, shall include information on curriculum goals, computer activities, curriculum support, technical support, software resources, hardware resources, professional development, and methods of evaluating the outcome of the plan.

Each school board shall designate a supervisory officer to be responsible for its annual plan. It shall also provide comprehensive support for the implementation of computer technology in a manner that is appropriate to local needs and resources.

All aspects of planning shall be focused to meet the needs of learners and learning objectives. Local curriculum development, implementation, and in-service activities shall reflect an integrated approach to incorporating computer technology into the learning process to facilitate a holistic curriculum.

Staff development on the educational use of computers is a continuing process. Teachers are also learners; they have varied learning styles and are at different stages of knowledge and comfort with computer technology.

Staff development opportunities offered by the board shall accommodate these differences.

The board plan shall provide the following:

Curriculum

- **a specific set of learning objectives for all levels and all curricular areas that can be facilitated by the use of computers**
- **the allocation of resource person(s), as required, to provide effective curriculum support for teachers, principals, and other staff in their integration of computer technology into the learning process**
- **strategies for the allocation of time for teachers to develop computer implementation activities**
- **processes for the sharing of curriculum resources among schools, divisions, and departments**

Professional development

- **strategies for ongoing support for staff to enhance their computer skills, knowledge, and understanding of the impact of computer technology on the educational process**
- **plans for comprehensive staff development in the area of computers in education (including classroom curriculum activities, software applications, and hardware operation) through the use of workshops, conferences, courses, coaching, and user groups**
- **mechanisms for the sharing of information and experience among educators, in both print and electronic form**
- **methods for identifying the most effective use of computers and incorporating these activities into all curriculum resources and professional development activities**
- **methods of informing staff of relevant courses that can enhance their understanding of the use of computer technology in the classroom**

Community Interaction

- methods for sharing information about the use of computer technology in the learning process with parents and the community at large
- methods of encouraging community/parental involvement in both the development and implementation of board/school plans
- strategies for identifying available computer resources within the community and incorporating them into the school program
- procedures for making school computer resources available to the community

Special Education

- ways of involving the community and its resources in both the planning for and the use of computer technology with learners with exceptionalities
- methods of allocating computer resources to meet the needs of learners with exceptionalities
- ways of involving implementation, planning, and review committees (IPRCs) in planning ways of using technology to serve the needs of learners with exceptionalities
- the provision of opportunities for teacher aides and other support staff to become familiar with and competent in the application of the computer technology used by learners with exceptionalities
- the provision of enhanced opportunities for learning and communicating through the use of assistive devices provided by advanced technology for physically and mentally challenged learners

Special Needs Learners

- the allocation of hardware and software resources that facilitate the learning of English for learners of English as a second language or English skills development

Hardware and Software Acquisition

- an inventory of computer resources already available within the board's schools (Since computer technology is changing at such a rapid rate, planning must include methods of reallocating and upgrading older models as well as enhancing learning opportunities using new models.)
- the acquisition of sufficient computer hardware and software so that every learner has access to a computer for an average of 2.5 hours per week — a ratio of approximately one computer for every ten learners (This is the recommended minimum time that learners require according to the Organization for Economic and Cooperative Development.)
- provisions for ergonomical environments (e.g., correct lighting, suitable furniture)
- provisions for the acquisition of appropriate computer software to meet learning objectives

Technical Support

- the provision of technical support resource person(s), as required, to provide teachers, principals, and other staff with effective assistance in the use of computer hardware and software

The Ministry of Education encourages school boards to use the following three checklists in their planning for the use of computers across the curriculum in both the elementary and secondary panels.

Computer Hardware

Has the board:

- acquired microcomputers that meet the functional requirements published by the ministry?
- provided appropriate furniture, lighting, space, electrical outlets, and cabling to ensure an ergonomically sound and safe environment?
- provided sufficient numbers of microcomputers to allow every learner access to them?
- purchased the necessary peripherals to permit flexible and wide-ranging use of the new technology in all areas of study?
- set up configurations of computers that include stand-alone word stations and in-school and beyond-school networking?
- provided the necessary elements for local and long-distance communication?
- acquired specialized hardware and peripherals in order to ensure equality of access for learners with exceptionalities?

Educational Software

Is the board using computer-based learning materials that:

- empower learners to explore and enjoy enriched learning environments?
- employ the principles of sound learning theories?

- provide opportunities for original thought through open-ended creative experience and inquiry?
- challenge the intellect through the utilization of the technologies?
- focus on the process of learning as well as on content?
- allow for individual learning styles and abilities?
- span a variety of subject areas and levels?
- provide for the needs of learners with exceptionalities?
- encourage social interaction and peer tutoring?
- can be easily used, even by novices?
- provide networking opportunities for learners?
- are free of prejudice, bias, and discrimination?

Staff Support

Has the board:

- appointed personnel, as required, to provide effective curriculum and technical support for teachers, principals, and other administrators in their implementation of computer technology?
- allocated time for teachers to develop comprehensive implementation strategies?
- provided in-service training for teachers in the curriculum-based use of computer technology?
- provided release time for this in-service training for teachers, consultants, principals, and other administrators?

- provided for the sharing of curriculum, technical, and in-service resources with other boards?
- designed activities to foster awareness (on the part of teachers, consultants, principals, and other administrators) of research findings applicable to the use of computer technology?
- shared information about the integration of computer technology into the learning process with parents and the community at large?

Responsibilities of the Principal

Planning and implementation at the school level are the responsibility of the school principal, although they should involve consultation with representatives from across the divisions and subjects. These representatives and the principal can form a "Computers Across the Curriculum Team".

The principal shall be responsible for the following:

- **developing the school's computer plan**
- **allocating computer hardware and software and selecting new computer-related resources to provide equity for all learners and subjects**
- **co-ordinating a school plan of computer learning activities so that all requisite areas of the learning process are sequentially covered**
- **encouraging the shared management of the implementation of computers so that all staff have input into, and a sense of ownership of, the process**
- **assisting in the provision of human resources, materials, and facilities (scheduling time and organizing locations so that all learners and staff have maximum access to computer equipment and software within the school)**

- supporting the implementation of computers across the curriculum by identifying staff who can provide expertise with software and hardware problems that may arise
- organizing computers in configurations that match curriculum needs and the teaching/learning strategies used at the school. These configurations can include computers operating singly, in clusters, in laboratories, and in networked and non-networked configurations.
- ensuring that, in co-operation with teachers, the evaluation of teachers includes an assessment of their implementation of computer technology in the curriculum and identifies areas for personal growth in this area
- developing a personal plan to upgrade their knowledge of appropriate uses of computer technology in the curriculum
- modelling the effective use of computer technology to staff and learners
- facilitating staff involvement and becoming involved themselves in professional development activities that are available within the school, the board, faculties of education, and the ministry, as well as from the manufacturers of equipment
- monitoring equity of access in the implementation process
- facilitating the use of computer resources for community use where applicable
- communicating with the board, other schools, other boards, the community, and the Ministry of Education to share ideas and expertise

The school's staff, under the direction of the principal, shall prepare an annual computer technology plan that describes the process whereby the school shall incorporate computer technology into the school curriculum. The plan will be developed co-operatively to reflect the plans of individual teachers and be consistent with board and Ministry of Education objectives.

The school plan shall outline curriculum goals and activities for the school, resources available to the staff, professional development activities, software resources, hardware resources, and methods for evaluating the program. The plan shall take into consideration the special characteristics of the school, the individual needs of its learners, and the expectations of parents and the community. It will make effective use of existing equipment, the skills of the staff, and the computer resources within the community. It will also project the growth of computer technology activities and equipment during the year.

The school should provide a copy of its computer technology plan to the board to assist with overall board planning.

Responsibilities of the Teacher

Teachers shall integrate computer technology into the learning process. They are responsible for the following:

- **co-operating with other staff members in planning programs**
- **ensuring that programs recognize learners' needs and abilities**
- **establishing ways in which computers can be used to accomplish curricular aims and objectives and identifying and organizing resources to support the planned activities**
- **providing learners with opportunities to use computer technology for problem solving, communicating, collaborating, experimenting, and creating through a variety of activities**
- **providing equitable access to computer learning activities for all learners to meet their individual needs**
- **continuing to develop competencies in the use of computer technology for integration into their classroom programs**
- **modelling the effective use of computer technology to their classes**
- **evaluating learner progress in learning activities, considering all factors including the learner's use of computer technology in particular learning activities**
- **evaluating the components of their classroom programs that involve the use of computers by learners in terms of their meeting learner needs**
- **reflecting on their planning and making revisions where necessary**

Evaluation

Assessment provides educators with information on learner progress that is essential for the development of individualized programs and the evaluation of the effectiveness of a curriculum program. In general, the assessment of the use of computer technology in a specific curriculum area will relate to the meeting of objectives and aims in that area. However, there are a number of areas in which assessment and evaluation of computer learning must take place.

Initially, teachers may find it useful to diagnose learners' computer skills. This will allow them to determine the scope of the computer applications that will be possible. Diagnostic assessment also helps teachers plan the specific skills that must be taught.

New knowledge, attitudes, and skills promoted through the use of computers can be evaluated, but learners' technical competency should remain secondary. For example, the main objective of a Grade 5 teacher is not to develop word processing skills at a secretarial level but ultimately to enhance writing and communication skills through the use of various resources for each learner in the class.

One feature of computers is that they allow learners to make mistakes and learn from them in a non-critical environment. This in turn fosters in learners the ability to evaluate themselves. Self-evaluation is an essential skill that individuals will require throughout their lives.

The evaluation of learners should be both formative and summative. Ongoing assessment allows teachers to monitor learner progress and adjust programs as required. Summative evaluation provides a means of taking stock of learner achievements at the end of a unit or a course. There is a need to reconsider all assessment and evaluation whenever computer technology is being used.

Boards shall:

- **provide methods for the evaluation of the outcome of its plan for the integration of computers across the curriculum.**

Principals shall:

- **ensure that, in co-operation with teachers, the evaluation of teachers includes an assessment of their implementation of computer technology in the curriculum and identifies areas for personal growth in this area;**
- **ensure that the school plan outlines methods for evaluating the program.**

Teachers shall:

- **assess learners' individual needs that could be addressed by the use of computers;**
- **evaluate computer activities in terms of their meeting learner needs;**
- **reflect on their own planning and make revisions where necessary;**
- **include an evaluation of the results of a learner's computer activities when evaluating the learner's progress;**
- **include the learner's progress in the use of the computer in reports to parents or guardians.**

Conclusion

The use of computers across the curriculum will contribute significantly to the achievement of Ontario's learners and the realization of the goals of education. The myriad applications of computer technology are already transforming education for learners of all ages. This is especially true for learners with special needs whose opportunities for an equitable education that will provide them with a chance to participate fully in society have been enormously enhanced by the use of computer technology.

While it is clear that computer technology can play an important role in education, its successful implementation across the curriculum is dependent on those using it. The importance to this process of all educators — and especially the classroom teacher — cannot be overemphasized. Knowledgeable, enthusiastic educators are essential if computers are to have the significant impact on education that is expected of them.

It is clear that the use of computer technology in education will continue to improve and spread in the future at an exponential rate. For this reason educators must make every attempt to keep abreast of new technology and new applications of computers in education.

Boards and schools will have to update their plans for the use of computer technology across the curriculum on a continuing basis.

The Ministry of Education will assist them in this task through the regular dissemination of current information on the use of computer technology in education. In this way Ontario's learners will be prepared for the world of the future in which education will be a lifelong process.

Glossary

Access

- retrieve data from storage or to place in storage
- loading a program from disk; running a video disk through a computer; finding information on a CD ROM

Associated Technology

- technology (peripherals) which can be used (accessed) through the computer to enhance its use such as CD-ROM, modem, videodisc, printers, CAD/CAM
- a printer to provide a hard copy (printed on paper) of a story; use of a videodisc in the presentation of a project; composition of a musical piece; control of a construction set (Technics)

CAD

- Computer Aided Design, graphics program which assists in the design and/or drawing of products and/or plans
- assists in the design of microcomputer circuitry; design of containers for a new product, saving time, money and resources

CAM

- Computer Aided Manufacture, controls the automated production of materials
- computer control of assembly lines; robotics

CD-ROM

- Compact Disc Read Only Memory, a large amount of information (data) which has been pressed onto a compact disc which then can be read back at a later date; information cannot be saved on this medium
- entire encyclopedia stored on disc for easy reference and retrieval; talking books which read stories in various languages; define specific works or graphics

Clusters

- are small groups of computers located within a classroom

Communicating

- contacting and interacting with another person or persons on the network or through the use of telecommunications

Computer

- a machine which is programmable and capable of processing information
- unlike a calculator which is used strictly for computation

Computer Capable

- ability to use the computer physically and cognitively to facilitate learning
- use of an augmentative device to communicate

Computer Network

- a series of computers linked together by special cables or via telephone cables so they can pass information to each other or share equipment

Computer Program

- is a set of instructions entered into or stored in a computer which allows the computer to carry out a specific task

Computer Technology

- see Computer/Associated Technology

Computers Across the Curriculum

- the utilization of computers and associated technologies within every grade and subject area to facilitate learning and to augment the program offered in that class

Conferencing Software

- permits two or more people to communicate with one or another through the use of the computer and associated technologies

Curriculum-based Use of Computer Technology

- integrates the technology into the existing program within any classroom
- the technology does not drive the activities which exist within the classroom but enhances them

Curriculum Support

- methodologies which facilitate the integration of computer technologies within the classroom

Data Bases

- is an organized collection of data stored in a computer-readable format. It works like a card catalogue system where data is kept on a particular area or topic. The data can be manipulated to find commonalities, trends, specific characteristic, etc. Data is a single piece of information about a person, place or thing.

Desktop Publishing

- a word processing system that allows for the integration of text and graphics on the screen to produce newsletters, flyers, etc.

Desktop Video

- software which allows for the integration of video, text, sound on the screen which can be stored and shown at a later time.

Electronic Bulletin Board

- uses electronic mail and modem lines to link different computer users together. Messages, requests, questions and responses can be posted.

Electronic Technology

- see Computer/Associated Technology

Equitable Access

- use of computer and related educational technology based upon needs (affective, cognitive, physical, linguistic, cultural)

Equity of Outcome

- provides an opportunity for everyone to progress, develop and achieve to the extent of his/her potential in a dignified manner through the identification and elimination of systemic barriers that impede the equitable treatment of the person.

Ergonomics

- improve how human beings and machines interact physically focusing on optimizing safety and productivity.

- have the keyboard and monitor at a reasonable height so the user is not physically uncomfortable; provide sufficient room for free movement between machines; peripherals and classroom.

Experimentation

- the non-threatening nature of computer technology provides an opportunity for users to attempt a variety of activities in a non-judgemental environment.

Fileserver

- computer which stores programs for workstations on the network and co-ordinates access to those files and the peripherals on the network.

Global Data Bases

- are data bases which exist throughout the world and are accessable through the use of telecommunications.

Graphics Editor

- permits the creation of static or full motion pictures, graphs, charts and text through the use of computer technology.

Hardware

- machinery which is assembled to permit the user to utilize computer software.

Holistic Approach

- integration of computer technology into the philosophy and goals of the educational environment.

Individualized Learning

- tailors the program to an individual's needs.
- characteristics of a software package can be modified to meet specific needs of an individual.

Inquiry Learning

- permits the user the opportunity to learn through the investigation of various resources associated with the computer technology.

Integration

- utilization of computers and related educational technology into all aspects of the curriculum; another tool to facilitate learning
- another medium for artistic expression (paint or graphics package); composition of music through the use of a midi and keyboard; use of probes and other testing equipment attached to a computer to record and analyze results.

Interactive Learning

- the user takes on an active role in his/her learning by manipulating information stored within the computer and associated technologies.

LAN

- Local Area Network, where a number of computers and peripherals are hooked up together so they can communicate with one another; connected by cables within the same building to permit access to each other.
- students can use the same printer; user can leave messages with one another or carry on immediate written communications with each other.

Logo

- highly interactive language which permits graphic representation of commands given an on screen turtle (actually a triangle).

Modem

- a device that connects one computer to another, usually by telephone lines.

Multimedia

- different forms of information (data) which can be combined to produce a single presentation

Network

- see Computer Network

Peripheral

- a device that is connected to the computer and controlled by it. Printers, CD ROMs, video disc players can be peripherals.

Scanner

- a peripheral which can copy printed/graphical information from paper into an electronic form which can be understood by the computer.
- drawings can be scanned into text such that it appears as one document.

Simulation

- a computer program that operates as a model and imitates real-life situations.

Software

- instructions or directions to the computer on how to carry out specific functions.

Spreadsheet Software

- permits the user to consider the computer screen as a large piece of paper on which a variety of operations can take place such as mathematics, storage/retrieval of data; sorting of data, graphing, etc.

Stand-alone Workstation

- see Workstation

System Support

- assistance with any hardware or software problems related to the computer and associated technologies.

Telecommunications

- the sending and receiving of information between computers via the telephone lines or TV signals using a modem

Technical Support

- see System Support

Technology

- see Computer/Associated Technology

Unicorn Board

- an adaptive device which can be programmed for the physically disabled.

Videodisc

- a medium on which electronic information can be stored, usually graphical in nature.

"What If" programs

- see Simulations

Word Processing

- allows one to enter, edit and print out text.

Workstation

- a computer which can be connected to a network to enable it to access stored programs, peripherals and other workstations or can be an individual machine (stand alone).

The Ministry of Education wishes to acknowledge the contribution of the following people who participated in the development of the *Computers Across the Curriculum*, Consultation Document.

Project Managers

Alain Aeschelmann	Curriculum Policy Development Branch Ministry of Education
Florence Scroggie	Curriculum Policy Development Branch Ministry of Education

Advisory Committee

Jim Breadner (Ontario Secondary School Teachers' Federation)	Scarborough Board of Education
Lynn Dunn	Centre for Curriculum Resources and Technologies Ministry of Education
Ronald Hurtubise (Association des pédagogues préoccupés par l'utilisation de l'informatique en éducation	Conseil des écoles séparées de Sudbury
Ron Miller (Educational Computing Organization of Ontario)	Waterloo County Board of Education
Françoise Ouellette (Association des enseignants et enseignantes franco-ontariens)	CSLF d'Ottawa-Carleton (catholique)
Susan Pekilis	Policy Analysis and Research Branch Ministry of Education
Ron Ragsdale (Observer)	Ontario Institute for Studies in Education
John Smith	Centre for Curriculum Resources and Technologies Ministry of Education
Jennifer Travis (Federation of Women Teachers' Associations of Ontario	Peel Board of Education Willow Way Public School
Gary Wills (Ontario Public School Teachers' Federation)	Sault Ste. Marie Board of Education Alex Muir Public School